

AMENDMENTS TO THE CLAIMS

This Listing of Claims will replace all prior versions, listing, of claims in the specification.

LISTING OF CLAIMS:

Claim 1 (original) A method for forming a semiconductor structure, said method comprising:

providing a crystalline silicon substrate having a buffer layer thereon, wherein said buffer layer comprising at least two layers of distinct material with sharp material transitions and epitaxial alignments between the layers and between the bottom layer of said buffer layer and said crystalline silicon substrate; and
forming a group-III nitride semiconductor structure on said buffer layer.

Claim 2 (original) The method according to claim 1, further comprising performing a surface reconstruction process to said crystalline silicon substrate.

Claim 3 (original) The method according to claim 2, wherein said surface reconstruction process comprises a thermal annealing in ultrahigh vacuum (UHV).

Claim 4 (original) The method according to claim 2, wherein said surface reconstruction process comprises an *in-situ* hydrogen-plasma cleaning process.

Claim 5 (original) The method according to claim 2, wherein said surface reconstruction process comprises an *ex-situ* wet etching process.

Claim 6 (original) The method according to claim 1, wherein said forming said buffer layer comprises:

forming a single-crystal silicon nitride layer on a silicon (111) substrate;
and
forming a group-III nitride layer on said single-crystal silicon nitride layer.

Claim 7 (original) The method according to claim 6, wherein said forming said single-crystal silicon nitride layer comprises performing a nitrogen-plasma nitridation to said silicon (111) substrate.

Claim 8 (original) The method according to claim 6, wherein said forming said single-crystal silicon nitride layer comprises performing a thermal nitridation to said silicon (111) substrate.

Claim 9 (original) The method according to claim 6, wherein said forming said single-crystal silicon nitride layer comprises performing a chemical vapor deposition to said silicon (111) substrate.

Claim 10 (original) The method according to claim 6, wherein said forming said group-III nitride layer comprises:

performing an aluminum pre-deposition process to said single-crystal silicon nitride layer terminated by nitrogen surface adatoms without introducing reactive nitrogen species to form an aluminum pre-deposition atomic layer on said single silicon nitride layer;

performing a thermal annealing process to said aluminum pre-deposition atomic layer to form a single-crystal aluminum nitride monolayer on said single-crystal silicon nitride layer; and

performing an aluminum nitride epitaxial growth process to said single-crystal aluminum nitride monolayer to form said group-III nitride layer on said single-crystal aluminum nitride monolayer.

Claim 11 (original) The method according to claim 1, wherein said group-III nitride semiconductor structure is formed by chemical vapor deposition method.

Claim 12 (original) The method according to claim 1, wherein said group-III nitride semiconductor structure is formed by molecular beam epitaxy method.

Claim 13 (original) The method according to claim 1, wherein said group-III nitride semiconductor structure is a group-III nitride single layer.

Claim 14 (original) The method according to claim 1, wherein said group-III nitride semiconductor structure is a group-III nitride multiple-layer structure.

Claim 15 (original) The method according to claim 1, wherein said group-III nitride semiconductor structure is a gallium nitride epitaxial layer.

Claim 16 (original) A method for growing a group-III nitride semiconductor heteroepitaxial structure, said method comprising:

providing a silicon (111) substrate;

performing a nitrogen-plasma nitridation process to said silicon (111) substrate to form a single-crystal silicon nitride layer on said silicon (111) substrate;

performing an aluminum pre-deposition process to said single-crystal silicon nitride layer terminated by nitrogen surface adatoms without introducing reactive nitrogen species to form an aluminum pre-deposition atomic layer on said single-crystal silicon nitride layer;

performing a thermal annealing process to said aluminum pre-deposition atomic layer to form a single-crystal aluminum nitride monolayer on said single-

crystal silicon nitride layer;

performing an aluminum nitride epitaxial growth process to said single-crystal aluminum nitride monolayer to form an aluminum nitride epitaxial buffer layer on said single-crystal silicon nitride layer; and

forming a group-III nitride semiconductor heteroepitaxial structure by epitaxial process on said aluminum nitride epitaxial buffer layer.

Claim 17 (original) The method according to claim 16, further comprising performing a thermal annealing in ultrahigh vacuum to said silicon (111) substrate to form a reconstructed silicon (111) surface.

Claim 18 (original) The method according to claim 16, further comprising performing an active hydrogen plasma cleaning process to said silicon (111) substrate to form a clean and smooth silicon (111) substrate.

Claim 19 (original) The method according to claim 16, further comprising performing an ex-situ wet etching process to said silicon (111) substrate to form a clean and smooth silicon (111) surface.

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Claim 20 (original) The method according to claim 16, wherein said performing a nitrogen-plasma nitridation process to said silicon (111) substrate to form a said single-crystal silicon nitride layer on said silicon (111) substrate is a thermal nitridation process.

Claims 21-34 (canceled).